THE PLANT DISEASE REPORTER

Issued By

PLANT DISEASE EPIDEMICS
and
IDENTIFICATION SECTION

AGRICULTURAL RESEARCH SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE

LIBRARY
SEP 16 1955
U. S. DEPARTMENT OF AGRICULTURE

Volume 39 Number 9

September 15, 1955

The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Plant Disease Epidemics and Identification Section serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

THE PLANT DISEASE REPORTER

Issued by

PLANT DISEASE EPIDEMICS AND IDENTIFICATION SECTION

Horticultural Crops Research Branch Plant Industry Station, Beltsville, Maryland
Volume 39 September 15, 1955 Number 9

IN THIS ISSUE

Virus Diseases and Virus Suspected: L. G. WEATHERS et al. describe a severe bud-union disorder of Troyer citrange rootstocks with Eureka lemon tops observed in southern California, page 665. W. H. SILL, Jr., and E. D. HANSING discuss the distribution and importance of barley stripe mosaic in Kansas where two strains of the virus have been found, page 670. W. J. MARTIN reports studies confirming varietal differences in reaction to sweetpotato internal cork, page 673.

Evidence that in most pea varieties storage of seed for several years eliminates seed-borne infection by Ascochyta without appreciably lessening germination and emergence is reported by V. R. WALLEN, page 674.

W. J. MARTIN et al. report that methyl bromide fumigation is a practical and effective method of controlling Rhizoctonia damping-off in pepper seedbeds, page 678.

One of the organisms isolated from soybean seedlings attacked by damping-off in North Carolina in 1954 was a species of Phytophthora, according to C. B. SKOTLAND, who summarrizes results of preliminary studies on the disease and the fungus, page 682.

Antibiotics: Investigations reported by R. W. NEWBURGH and VERNON H. CHELDELIN show that certain antibiotics may inhibit growth of the wheat bunt fungus, Tilletia caries, in culture, page 684.

J. R. HARDISON et al. report some additional grass hosts for the dwarf bunt Tilletia and give the known host list, page 685.

R. H. PORTER divides sorghum culms with heads affected by covered smut into classes according to whether main stem or sucker, or lodged or stunted culms, bear the affected heads, page 688.

EUGENE E. STAFFELDT and PAUL A. FRYXELL describe a method of estimating reaction of cotton varieties and selections to Verticillium wilt, page 690.

STEPHEN WILHELM et al. describe symptoms caused by Verticillium albo-atrum in some previously unrecorded hosts in California, page 693.

C. W. ROANE and S. B. FENNE contribute some new plant disease records for Virginia, page 695.

Unusual Records, page 697: Microstroma tonellianum on sweet cherries in Massachusetts, by PAUL L. LENTZ. Crown wart of alfalfa in Kentucky, by N. L. TAYLOR and LAWRENCE HENSON.

Announcement, page 698: Preliminary program of symposia to be sponsored jointly by AAAS and American Phytopathological Society at the Atlanta Meeting.

July weather, page 699.

Manuscripts for the Reporter, page 700.

A BUD-UNION AND ROOTSTOCK DISORDER OF TROYER CITRANGE WITH EUREKA LEMON TOPS[1]

L. G. Weathers, E. C. Calavan, J. M. Wallace, and D. W. Christiansen[2]

Abstract

Eureka lemon trees propagated on Troyer citrange rootstocks show a severe bud-union disorder after 3 years or more of good growth. Starch depletion of the rootstock is accompanied or followed by poor growth and general chlorosis of the lemon top. Extensive bark and wood necrosis of the citrange rootstock frequently develops and sometimes causes the death of trees. The possibility that the disorder may be caused by a virus is discussed.

For several years Troyer citrange (trifoliate orange X navel orange) rootstocks have been under observation in experimental and limited commercial plantings in southern California as a substitute for sour orange rootstocks for oranges, particularly for orange replants in existing orchards. So far they have proved to be satisfactory for this purpose (1, 3, 4, 5). After their release as trial rootstocks for oranges, Troyer citrange rootstocks with various lemon scions were established in several experimental plantings.

A bud-union disturbance of old-line Eureka lemon on Troyer citrange rootstocks was reported in 1952 by Bitters (2), who also noted "evidence of exocortis at or below the crown roots" of some trees. In September, 1954, a very serious disorder in trees of Eureka lemon on Troyer citrange was observed in one of the experimental plots in Ventura County (5). In this plot all the Eureka lemon tops on Troyer citrange rootstocks turned yellow, set a heavy crop of fruit, and declined markedly. Examination revealed a distrubance at the bud union, with retarded growth, deterioration, and gumming of the Troyer citrange (Fig. 1, A). Bark and wood necrosis, accompanied by some gumming and resembling dry root rot, had developed in the rootstocks (Fig. 1, B). The affected wood was firm, dry, and stained light brown, but lacked the usual odor of dry root rot. In some trees the necrosis involved the entire rootstock, while in others it occurred as localized lesions (Fig. 1, C) or in longitudinal strips. The lesions did not extend into the Eureka lemon portion of the trunk (Fig. 1, D). Both old-line and nucellar-line Eureka lemons on Troyer in this planting showed the disease, but the same tops on other rootstocks were not similarly affected.

A survey of other plantings of lemon on Troyer citrange in Ventura and Santa Barbara counties revealed that many of the 3- to 4-year-old trees of Frost, UCLA, Cook, and Hughes nucellar-line, and of Allen, Hughes, and Cascade old-line Eureka lemons, propagated on Troyer citrange, were declining or had died. Other cases have been observed recently in Orange County. The bud unions of affected trees were noticeably abnormal, with the lemon scion having overgrown the stock and the bark of the Troyer often having dried and adhered to the wood. A narrow dark-brown line in the bark and on the cambial face of the wood at the bud union suggested some form of incompatibility (Fig. 2, A). Treatment with iodine showed starch depletion in the Troyer rootstocks (Fig. 2, B), which is indicative of girdling near the bud union of a sufficient degree to restrict severely the translocation of carbohydrates to the roots. Wood necrosis had developed in the Troyer rootstocks of only a few trees and appeared to be a secondary symptom associated with fungus invasion of tissues weakened by girdling. Some trees without extensive wood necrosis have made a partial recovery. There was considerable variation in symptom expression on trees growing under different environmental conditions. Although there was no conclusive evidence of a causal relationship between the bud-union disorder and

---

[1] Paper No. 854, University of California Citrus Experiment Station, Riverside, California.

[2] Assistant Plant Pathologist, Associate Plant Pathologist, Plant Pathologist, and Senior Laboratory Technician, respectively, Department of Plant Pathology, University of California Citrus Experiment Station, Riverside, California.

The authors gratefully acknowledge the cooperation of Drs. L. D. Batchelor and W. P. Bitters of the Department of Horticulture, University of California Citrus Experiment Station; and of G. E. Goodall, R. G. Platt, and the late F. A. White of the University of California Agricultural Extension Service. The authors also wish to express their appreciation to Citrus Field Research, Inc., Limoneira Company, Rancho Sespe, Utt Development Company, Ltd., Ventura Coastal Lemon Company, and to the indivual growers who planted and maintained the experimental plots.

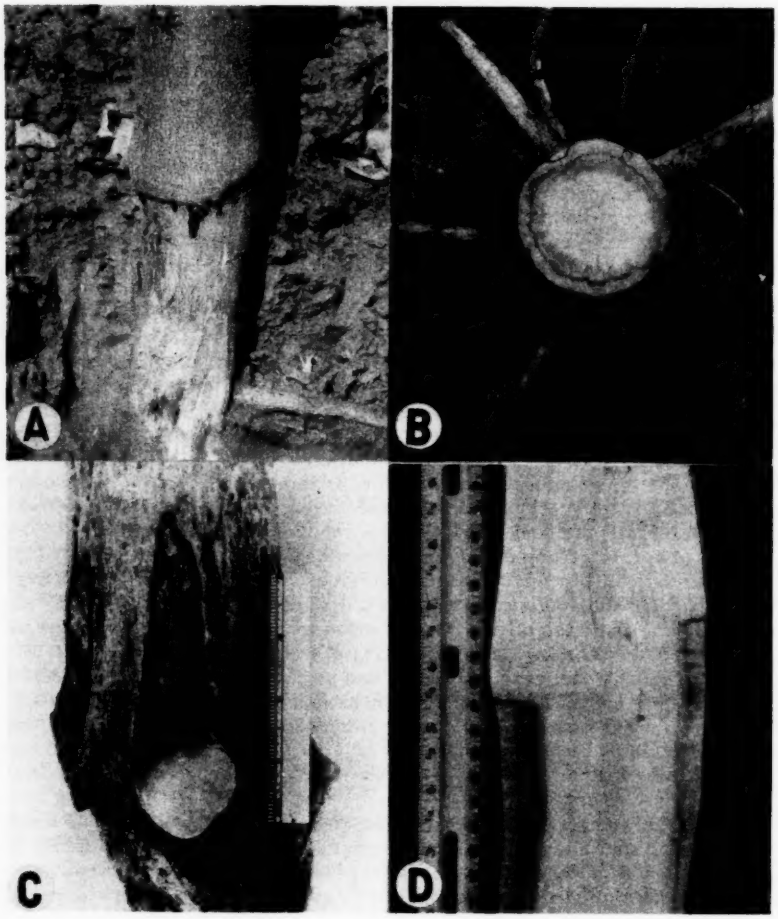


FIGURE 1. A. Disorder of Troyer citrange rootstock with Eureka lemon top, showing gumming at the bud union and retarded growth of the rootstock. B. Cross-section of Troyer citrange rootstock, showing the developing necrosis. C. Localized lesion on Troyer citrange rootstock. D. Longitudinal section through bud union of diseased Troyer citrange rootstock with Eureka lemon scion. Note the sharp line of demarcation at the union and the discolored wood of the rootstock. (Photographs A, B, and D by R. G. Platt; C by K. L. Middleham).

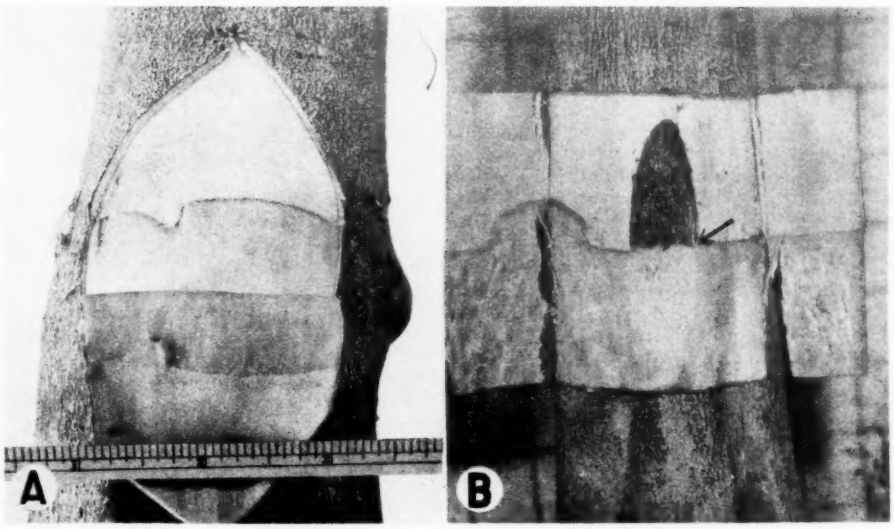


FIGURE 2. A. Four-year-old nucellar Eureka lemon on Troyer citrange. A flap of bark has been peeled downward across the union to show the dark line on the cambial faces of the wood and bark. B. Four-year-old nucellar Eureka lemon on Troyer citrange. The bark across the union was cut away. A groove was chiseled across the union and the wood treated with iodine. Note color reaction for starch in the Eureka lemon wood above the union (arrow) and lack of color reaction in the Troyer citrange wood. (Photograph A by K. L. Middleham; B by R. G. Platt).

the necrotic lesions, it was observed that the bud-union disorder of Eureka lemon on Troyer citrange frequently occurs in the absence of rootstock lesions. With this combination no lesions were found without a conspicuous bud-union disorder.

Cook nucellar-line Eureka lemons topworked on Valencia sweet orange on Troyer citrange rootstocks in one grove in Ventura County were found declining severely 3 years after topworking. Lesions had developed in the Troyer rootstocks of some trees, but no brown line or marked overgrowth was found at either the lemon-orange or the orange-citrange unions, as was the case where Eureka lemon was propagated directly on Troyer citrange. However, the bark of the Troyer rootstock was very thin and dry and adhered very tightly to the wood. Tests with iodine indicated low starch content in the roots.

Fungi of several genera were isolated from the bark and wood of diseased Troyer citrange rootstocks from several locations in Ventura County. Fungi commonly found were Alternaria spp., Fusarium spp., Penicillium spp., and a fungus tentatively identified as Gliocladium roseum Bainier. These isolates have not yet been fully tested by inoculation into Troyer citrange, but from previous tests it is known that they are ordinarily present on citrus as saprophytes or weak parasites of weakened tissues. Attempts to isolate Phytophthora spp. from the diseased tissues and from the soil adjacent to the Troyer rootstocks were unsuccessful.

The cause of this disorder of Troyer citrange rootstock has not been determined. However, the following points should be noted: 1) Eureka is the only lemon variety known to be associated with this disorder. Lisbon lemon strains and oranges on Troyer citrange rootstocks have not thus far been similarly affected. 2) Until symptoms appear, 2 or more years after planting, the trees are very vigorous and apparently healthy. The most vigorous trees are often the first to deteriorate. 3) Soil type, soil fumigation with DD, and irrigation practices appear to have little or no influence on the appearance of this disorder. 4) Many trees become diseased before developing wood rot or any other evidence of fungus activity. Since the fungi thus far isolated from diseased roots appear to be secondary invaders, it is very doubtful that fungi.

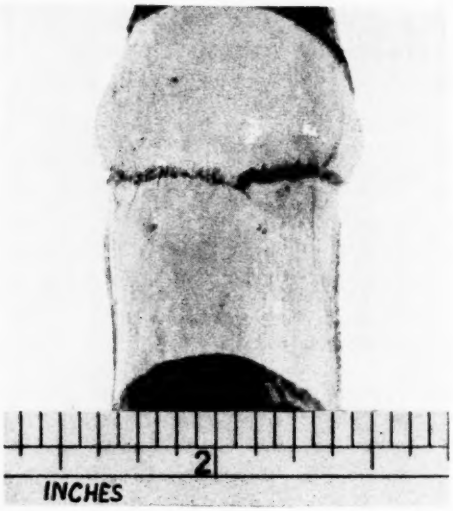


FIGURE 3. Bud-union disorder of nucellar Eureka lemon on trifoliate orange rootstock one year after budding. Bark removed to show groove and dark line at the union. (Photograph by K. L. Middleham).

are the primary cause. 5) Several cases of failure of old-line and nucellar-line Eureka lemon on rootstocks of trifoliate orange, Poncirus trifoliata (Linn.) Raf., sometimes within a year after budding, have recently been observed (Figure 3). The disorder of Eureka lemon on trifoliate orange reveals a bud-union condition very similar to that observed on trees of Eureka lemon on Troyer citrange rootstocks. A young Messina-type lemon on trifoliate orange in Santa Barbara County has also developed a bud-union disturbance and exocortis. Wood necrosis has not been observed in any of the diseased trifoliate orange rootstocks.

The Troyer citrange rootstock disorder may be caused by a virus or by a form of incompatibility between Eureka lemon and Troyer citrange. The occurrence of rootstock lesions in trees having Valencia sweet orange interstocks disfavors direct incompatibility as the cause of this symptom, since the Valencia interstock separating the Eureka lemon from the Troyer citrange is compatible with both. This indicates that the Eureka lemon may carry a virus that seriously affects Troyer citrange. Furthermore, inasmuch as nucellar lines of Eureka on Troyer citrange react in the same way as trees of old-line Eureka on this rootstock, any virus present must be either seed-transmissible or very readily transmissible by mechanical means or by a vector.

Other studies have shown that some and possibly all old-line Eureka lemons carry a transmissible factor, possibly a virus, which retards the growth of nucellar Eureka lemons (7). The retardation of growth of nucellar-line Eureka lemons after graft-inoculation from old-line Eurekas does not appear to be related to the disorder of Eureka lemon on Troyer citrange. The virus or causal factor of the former is not present in nucellar-line Eureka lemons; whereas the factor responsible for the Eureka-Troyer disorder is present in all the nucellar-line Eurekas tested. Trees of Frost and UCLA nucellar-line Eureka on some rootstocks other than Troyer citrange or trifoliate orange are retarded in growth only after being graft-inoculated from old-line Eureka sources, but the same nucellar lines when budded on Troyer citrange subsequently develop the Troyer rootstock disorder without inoculation. If a virus is involved in the latter disorder it must be present generally in nucellar Eurekas or, as is somewhat less likely, seed transmitted and carried latently in Troyer citrange seedlings. It is also known that trifoliate orange rootstocks having certain old-line Eureka lemon tops show symptoms of exocortis. However, exocortis is not necessarily the cause of either the bud-union trouble or the necrosis of Troyer. Preliminary evidence obtained by Bitters et al. (6) with Frost Eureka, and by the authors with nucellar-line Allen Eureka, indicates that nucellar lines of Eureka lemon are not carrying exocortis. Experiments aimed at identifying the agent or agents responsible for the Troyer citrange rootstock disorder are now in progress.

Literature Cited

1. Batchelor, L. D., and W. P. Bitters. 1952. Two promising rootstocks for citrus in California. California Citrograph 37: 390-391, 409-410.
2. Bitters, W. P. 1952. Exocortis on trifoliate. Citrus Leaves 32 (9): 14-16, 34.
3. _____, and L. D. Batchelor. 1951. Rootstock recommendations for California citrus. California Citrograph 36: 488, 507-508, 510-511.
4. _____, and _____. 1953. Gummosis resistance of Troyer citrange. California Citrograph 38: 192, 200.
5. _____, L. D. Batchelor, J. P. Martin, E. C. Calavan, and L. G. Weathers. 1954. Troyer citrange rootstocks. California Citrograph 40: 46, 59-61.
6. _____, J. A. Brusca, and N. W. Dukeshire. 1954. Need for careful selection of lemon budwood shown by exocortis transmission tests. California Citrograph 39: 70-71, 84-85.
7. Calavan, E. C., J. M. Wallace, and L. G. Weathers. 1954. Transmission of a growth-retarding factor from old-line to young-line Eureka lemon trees. (Abstr.) Phytopathology 44: 483.

DEPARTMENT OF PLANT PATHOLOGY, UNIVERSITY OF CALIFORNIA CITRUS EXPERIMENT STATION, RIVERSIDE, CALIFORNIA

SOME STUDIES ON BARLEY STRIPE MOSAIC (FALSE STRIPE) AND ITS DISTRIBUTION IN KANSAS[1]

W. H. Sill, Jr. and E. D. Hansing[2]

Summary

Two strains of barley stripe mosaic virus (false stripe) have been found in random samples of winter barley in Kansas. One has infected oats readily; the other has not. The former was more severe on the barley and wheat varieties tested. Of 116 farmers' seed samples of winter and spring barley that were tested, 25 were infected naturally with this seed-borne virus. These samples came from 18 widely dispersed counties of Kansas. Since some diseased plants tend to remain symptomless, it has not been possible as yet to determine the exact percentage of infected seed in any sample tested. However, it is believed that a seedling screening program for seed sources could be used satisfactorily to eliminate seed lots carrying appreciable percentages of infected seed.

Fields in the State showing severe losses have been seen but no loss estimates have been made.

While obtaining random plant samples during the winter of 1953-54 for a wheat streak mosaic survey (2), occasional samples of winter barley were collected. No barley samples were found infected with wheat streak mosaic but several developed symptoms somewhat similar to barley stripe mosaic, described as a seed-borne virus by McKinney (4). Using tissue from these plants, abrasive inoculations were made to wheat and barley seedlings. Symptoms developed which were more typical of barley stripe mosaic than of wheat streak mosaic. All plants inoculated as well as those originally brought from the field were kept to maturity and the seed harvested. Other plants showing similar symptoms were collected from the original sample fields. These, also, were grown to maturity in the greenhouse and harvested.

Eight hundred forty seeds from these plants were planted in several trials. Six hundred twenty-three plants grew of which 114, approximately 18 percent, eventually developed stripe mosaic symptoms. All manual inoculations from many of these plants to wheat and barley confirmed the presence of an infective agent that caused symptoms identical to those on the original samples and similar to descriptions of barley stripe mosaic (3, 4, 5, and 7).

Additional host range and symptomatology studies were made to verify the identity of the virus. An attempt, also, was made to determine the approximate distribution of the disease in the State.

Seedling Tests

The seedlings from the supposedly infected seeds, mentioned previously, were grown in 6-inch pots, 3 per pot, at winter greenhouse temperature (70-75° F) and light conditions. Symptoms appeared 2 weeks or more after seeding as reported by McKinney (5). Seedling symptoms in general were similar to those described by McKinney (6). Inoculations from many symptomless seedlings to wheat proved some to be infectious. These infected symptomless plants were marked. Some developed symptoms later but others did not show any symptoms until active growth after vernalization. A few never developed discernible symptoms, but remained symptomless even though diseased. This tendency has been discussed by McKinney (5) and will undoubtedly make the development of a completely satisfactory seed testing program difficult.

Strains

Two distinct strains of the virus were isolated from the seedlings grown from naturally infected seed. One did not infect oats, variety Cherokee, but gave typical stripe mosaic symp-

---

[1] Contribution No. 599, serial No. 460, Department of Botany and Plant Pathology, Kansas Agricultural Experiment Station, Manhattan.

[2] Assistant Professor of Botany and Plant Pathology, Professor of Botany and Plant Pathology, respectively, Kansas State College, Manhattan.

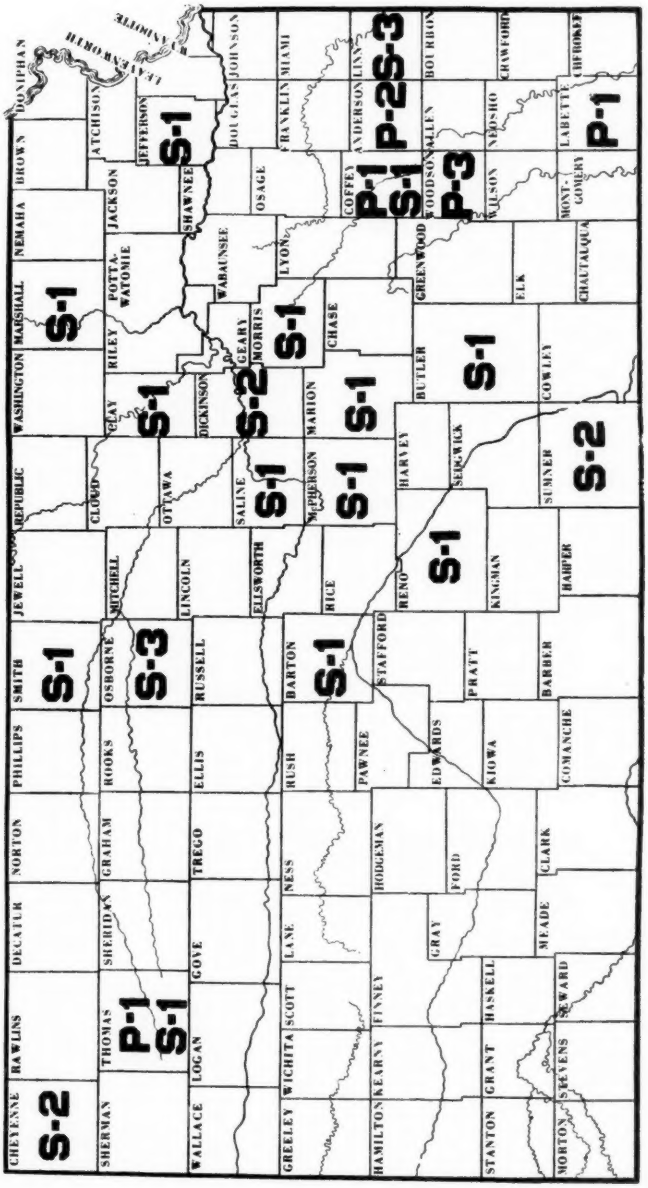


FIGURE 1. Kansas counties in which barley stripe mosaic has been found in either plant or seed samples. S = seed sample; P = plant sample; Number = number of positive samples collected from the county.

toms (3, 4, 5), on barley (variety Dicktoo), wheat (variety Comanche), Chenopodium album, and corn (varieties Golden Giant Sweet, Dakota White, Pride of Saline, and Midland). The other strain infected oats readily in addition to causing the typical symptoms on the other hosts mentioned. It was more severe on wheat and barley, causing much stunting, and considerable longitudinal leaf rolling in wheat. The stunting and general disease severity on six wheat varieties (Comanche, Concho, MoKing, Pawnee, Royal, and Stafford) were greater than that typical of wheat streak mosaic.

Both strains gave symptoms on New Dakold rye similar to those described by Slykhuis (7). Neither infected sorghum (varieties Atlas and Westland), garden beet (Early Wonder), alfalfa (Buffalo), bean (Scotia), tomato (Rutgers x Stokesdale), soybean (Perry), cucumber (Palmetto and Early White Spine), or Swiss chard.

McKinney (5) reported a collection which infected a small percentage of the oat plants inoculated and another which did not. Slykhuis (7) was not able to infect oats with his collection of the virus.

Distribution and Possible Losses

The virus was found in 4 out of 11 random samples of winter barley plants collected during the late fall of 1953-54 and in 4 out of 12 during 1954-55. Except for one sample from Thomas County, these all came from 4 southeastern counties (Fig. 1).

Farmer seed samples of both winter and spring barley were collected by the junior author throughout the State. A total of 116 samples was tested. Five of 16 samples of winter barley seed (variety Reno) were found to be infected. The positive samples came from Reno, Coffey, Cheyenne, and Sumner Counties. Twenty of 100 seed lots of spring barley tested were carrying the disease also. These included the following varieties: Beecher, Flynn, Trebi, and several which were doubtful or undesignated. Positive samples came from 15 counties: McPherson, Morris, Dickinson, Cheyenne, Clay, Osborne, Marion, Butler, Smith, Saline, Jefferson, Marshall, Barton, Linn, and Thomas. Most of these were in the eastern half of the State (Fig. 1). Sixteen other collections were questionable and further tests will be necessary to prove the presence of the virus in these seed lots. As yet no attempt has been made to determine accurately the percentage of infected seed in any sample sent in by farmers although at least 4 have produced a rather high percentage of diseased plants.

No attempts to determine losses owing to barley stripe mosaic have been made by the authors although in some infected fields which were re-examined obvious yield reduction was observed. The difficulty of determining diseased plants with certainty in the field owing to the tendency for symptoms to be masked (3, 5) has made attempts discouraging. Eslick (1) reported a 31 percent yield reduction over a 5-year period. Others (3, 5) have made loss estimates varying from about 30 to 90 percent.

Literature Cited

1. Eslick, R. F. 1953. Yield reductions in Glacier barley associated with a virus infection. Plant Dis. Reptr. 37: 290-291.
2. Fellows, Hurley, and Webster H. Sill, Jr. 1955. Predicting wheat streak mosaic epiphytotics in winter wheat. Plant Dis. Reptr. 39: 291-295.
3. Hagborg, W. A. F. 1954. Dwarfing of wheat and barley by the barley stripe mosaic (false stripe) virus. Canad. Jour. Bot. 32: 24-37.
4. McKinney, H. H. 1951. A seed-borne virus causing false-stripe symptoms in barley. Plant Dis. Reptr. 35: 48.
5. _____. 1953. New evidence on virus diseases in barley. Plant Dis. Reptr. 37: 292-295.
6. _____. 1954. Culture methods for detecting seed-borne virus in Glacier barley seedlings. Plant Dis. Reptr. 38: 152-162.
7. Slykhuis, J. T. 1952. Virus diseases of cereal crops in South Dakota. South Dakota Exp. Sta. Tech. Bull. 11.

DEPARTMENT OF BOTANY AND PLANT PATHOLOGY, KANSAS STATE COLLEGE, MANHATTAN

COMPARATIVE DEVELOPMENT OF INTERNAL CORK IN SWEETPOTATO VARIETIES UNIT 1 PORTO RICO AND EARLYPORT

W. J. Martin

In an earlier publication[1] it was indicated that the Earlyport variety (formerly designated L-240) of sweetpotato was tolerant to internal cork as compared with the variety Porto Rico. The following percentages of affected roots, grown from core-graft-inoculated samples, were reported: for Porto Rico 5.9 at harvest and 89.2 after storage; for Earlyport (L-240) 0.0 at harvest and 19.6 after storage.

Recently additional data were obtained on the comparative reaction of these varieties to internal cork. Field plantings were made of the two varieties side by side. The plants were all obtained from mother roots exhibiting typical and severe cork lesions (determined by slicing the root end of each mother root and using only those with severe cork lesions). At harvest on September 8, 1954, four samples of 50 roots each (all US no. 1 grade) were obtained from each variety. The samples were cut into slices approximately 1/16 inch thick and each root was classed into one of 5 classes, from 0 indicating no cork lesions to 4 indicating severe cork lesions. After storage on March 30, 1955 four 100-root samples were cut and examined for cork lesions and data recorded as above. A summary of these data is given in Table 1.

Table 1. Mean[a] percentage roots with internal cork lesions and mean disease index[b] in two varieties of sweetpotato.

Varieties	Percent cork affected	Disease index
Unit 1 at harvest	25.5	14.1
Earlyport at harvest	1.5	0.4
Unit 1 after storage	87.8	73.4
Earlyport after storage	56.0	45.5
L.S.D. 5%	6.16	6.90
L.S.D. 1%	8.53	9.56

[a] Mean of four samples of 50 roots each at harvest and 100 roots each after storage.

[b] Disease index was calculated by the following formula:

$$\frac{\text{Sum of number of roots in each class x class number}}{\text{4 x number of roots examined}} \times 100$$

The above data show that there is a striking difference between the two varieties in their reaction to internal cork. However, the difference does not appear to be so great as was indicated in the earlier report.

DEPARTMENT OF PLANT PATHOLOGY, LOUISIANA AGRICULTURAL EXPERIMENT STATION, BATON ROUGE, LOUISIANA

[1] Feazell, George, and W. J. Martin. 1953. Varietal reaction to internal cork of sweetpotatoes. Ann. Rept. Louisiana Agr. Exp. Sta. 1951-52: 121-122.

THE EFFECT OF STORAGE FOR SEVERAL YEARS ON THE VIABILITY OF ASCOCHYTA PISI IN PEA SEED AND ON THE GERMINATION OF THE SEED AND EMERGENCE[1]

V. R. Wallen[2]

Abstract

In tests involving 18 samples of pea seed varying in age from 2 to 13 years, it was demonstrated that in most varieties that had been stored for about 7 years seed-borne infections of Ascochyta pisi Lib. were eliminated without significant loss of germinative capacity of the seed or lack of emergence of seedlings.

It is proposed that this finding can be used as a practical means of controlling the leaf and pod spot disease of peas arising from seed-borne infections. It may also be employed with seed which has failed to obtain foundation status because of A. pisi infections, by making it possible to qualify the seed for certification after a period of storage.

Introduction

The decline in the viability of a seed-borne pathogenic fungus, without a corresponding decline in the germinability of the seed or emergence of seedlings, has been demonstrated in a few instances. Wilson and Newhall (6) and Coons (1) have shown that in celery seed Septoria apii, the fungus causing late blight, remains viable for only 2 or 3 years. Storage of the seed for that period is therefore recommended as a means of controlling the disease.

Crosier (3), in his work with the seed of hairy vetch (Vicia villosa), obtained evidence that prolonged storage served as a natural process for the elimination of seed-borne Ascochyta pisi. He found that the number of A. pisi seed associations decreased continuously during 1 to 2 years of warm dry storage while the percentage of viable seeds remained nearly constant for 4 years or more. In studies on the retention of the viability of seed of leguminous plants, McKee and Schoth (4) found that vetch seed remains viable for at least 5 years and that much older seed germinated well. Crocker (2) in summarizing the results of his work concluded that the seeds of members of the pea family are long-lived.

The absence of a practical treatment for pea seed that will eliminate seed-borne infections of Ascochyta pisi has resulted in serious crop losses and many growers of foundation pea seed have suffered loss because their seed was infected with A. pisi above the allowable tolerance. It was therefore decided to explore the effect of various storage periods at room temperature on the viability of the seed-borne pathogenic fungi and on the germination of the seed and emergence of seedlings. If a favorable relationship could be demonstrated between the viability of the fungi and the germinability of the seed, the requisite storage period could be employed for the control of seed-borne infections, and disqualified infected seed from foundation plantings could subsequently qualify for use as foundation stock.

Materials and Methods

Eighteen samples of infected pea seed were used in the tests, one from peas harvested in 1941, eight in 1947, one in 1950, two in 1951, four in 1952, and three in 1953. Immediately after the harvesting of the seed of these samples, an agar-plate test had been made to determine the fungi present in the seed and the germination percentage. In this test, 100 seeds were surface sterilized by soaking them for 15 minutes in a solution of a commercial sodium hypochlorite (Javex) diluted to 2% available chlorine, and without being washed were plated on 2% pea agar in Petri dishes at the rate of five seeds per dish. A record of the fungi growing from the seeds and the degree of germination of the seeds was made after 10 days' incubation at room temperature. The balance of the seed in each sample was placed in galvanized iron boxes and stored in a heated basement. The temperature of the basement fluctuated from 50° to 70° F and the relative humidity was approximately 70%. All of the seed samples were stored in this

---

[1] Contribution No. 1477 from the Botany and Plant Pathology Division, Science Service, Canada Department of Agriculture, Ottawa, Ontario.

[2] Plant Pathologist.

Table 1. The effect of varying periods of storage on the viability of Ascochyta pisi in pea seed and on germination and emergence.

Sample and year of production	Results in year of production			Results in December, 1954 and March, 1955				
	A. pisi %	Total fungi %	Germination %	A. pisi %	Total fungi %	Germination %	Emergence % Untreated	Emergence % Treated
45. Arthur - 1947	10	36	77	0	0	84	59	85
323. Arthur - 1947	10	68	93	0	0	96	80	93
559. Arthur - 1947	16	80	70	2	2	70	--	--
596. Wisconsin Sweet - 1947	10	98	86	0	0	86	46	79
598. Alderman - 1947	17	92	83	4	4	68	30	49
600. Glacier - 1947	14	98	74	0	2	88	79	86
58. Chancellor - 1947	14	79	91	0	0	92	87	96
52. Pride - 1947	13	105	78	0	0	86	62	72
-- Onward - 1941	13	105	90	0	0	4	0	2
136. Onward - 1950	6	51	97	1	1	93	96	99
-- T. Laxton - 1951	44	- *	87	16	16	90	91	87
234. Chancellor -1951	3	36	83	1	2	82	76	78
18. Arthur - 1953	1	18	95	2	19	99	92	92
17. Valley - 1953	1	22	98	1	6	98	96	100
15. Chancellor-1952	34	69	53	39	47	74	70	76
17. Arthur - 1952	19	108	26	36	54	68	50	76
16. Chancellor-1952	46	92	67	39	43	73	88	86
19. Chancellor-1953	5	66	99	6	22	99	98.	100

* - Sample tested for A. pisi only.

way until plate tests were repeated in December 1954 and March 1955 by means of the above technique.

In addition to the agar-plate test, the pea seed that had been stored for varying periods was subjected to a soil test to determine the degree of emergence of the seedlings. For this purpose, 100 seeds from each sample were treated with Orthocide 75 and similar lots of 100 seeds were left untreated. The treated and untreated seed was sown in an unsterilized John Innis soil mixture in flats, 100 seeds per flat. After 17 days in a greenhouse, a count of the emerging seedlings was made.

Results

Table 1 lists the 18 samples with their variety names, the year of production, the fungi found in each sample in the year of production, and the germination of the newly-harvested seed. It also records the results obtained from retesting the samples by the same technique in December 1954 and March 1955, together with the percentage emergence of seedlings.

It will be noted that in the year of production most of the seed samples were heavily infected with Ascochyta pisi. Of the eight samples that had been stored for 7 years, no A. pisi was isolated from six of the samples and in the other two only 2 percent and 4 percent of the seeds were still infected with A. pisi. It is also significant that there was almost a total absence of other fungi in the eight samples notwithstanding the fact that in the year of production the percentage of total fungi ranged from 36 to 105. The other fungi included representatives of Alternaria, Cladosporium, Fusarium, Stemphylium, Penicillium, Acromoniella, Aspergillus, Rhizopus, Mucor, Trichoderma, Verticillium, Papulaspora, and Cephalosporium. There was no significant decline in the viability of A. pisi in the six samples of seed harvested in 1952 and 1953. In the intermediate years of production, 1950 and 1951, the three samples showed a decline but not an elimination of A. pisi. The sample of the variety Onward that had been in storage for 13 years was free from fungi, but the seed was practically devoid of germinability.

The germination of the seed harvested from 1947 to 1953 remained at a high level. In the eight samples stored for 7 years only one showed a decrease and actually in some of them there was an increase. After shorter storage periods, the germination of the seed was as good as or better than that obtained in the year of production. The soil test for the degree of emergence of the seedlings revealed that the periods of storage had not materially affected the seed in this respect. It is of interest to note that the emergence of seedlings from the seed treated with Orthocide 75 was improved in practically every sample, so confirming the observations of Wallen, Wallace, and Bell (5) on the beneficial response of aged vegetable seed to seed treatment.

The results obtained from these trials indicate that in six of the eight samples of pea seed stored for 7 years, the Ascochyta pisi within the seed was not living and that the germinability of the seed was practically unimpaired. It was felt, however, that changes might have occurred in the stored seed that could inhibit the development of the fungus under the conditions of the plating method. To eliminate this possibility, three additional trials were made. For the first one, the sample of the variety Alderman was chosen. As shown in the table, this sample was harvested in 1947 and at that time was infected with A. pisi to the extent of 17 percent, but, after 7 years storage the degree of infection was 4 percent. Fifty seeds from this sample were soaked in the solution corrected to 2% chlorine, as before, but the seeds were then ground to a fine powder in a sterilized meat grinder, and the powder sprinkled lightly on 2% pea agar in Petri dishes and incubated for 10 days. No A. pisi developed in these dishes. In the second test, 50 seeds from the same sample of Alderman peas were soaked in the chlorine solution for 15 minutes, soaked for 48 hours in sterile distilled water, the seed coats removed, and the cotyledons, seed coats, and embryos plated on the 2% pea agar. After 10 days' incubation, no A. pisi developed in the dishes.

The third test was carried out to determine whether the aging of the seed had made it more permeable to the chlorine solution so that the A. pisi within the seed could have been killed by the chlorine solution rather than by an aging factor. One hundred seeds were taken from four of the samples used in the original tests, including No. 596, Wisconsin Sweet, harvested in 1947; No. 58, Chancellor, 1947; No. 136, Onward, 1950; and the Thomas Loxton sample harvested in 1951. The seeds were placed in sterilized distilled water, shaken on a mechanical shaker for 20 minutes, washed in fast-running tap water for 10 minutes, then given a final rinse in sterilized distilled water, plated on 2% pea agar, and incubated for 10 days. No Ascochyta pisi developed from the seeds of samples Nos. 596, 58, and 136. The more recently harvested seed of Thomas Laxton that had 44 percent of infected seed in 1951 and 16 percent in 1955, contained

only 1 percent after being cleansed with water. It would appear, therefore, that the use of the chlorine solution had not inhibited the development of the A. pisi from within the aged pea seed and that the absence of the fungus was due to the aging.

Conclusions

From these tests, it would appear that in most cases pea seed stored in a cool, dry atmosphere can outlive seed-borne fungi and still retain high capacity for germination and emergence. It is quite possible that the conditions prevailing at the time of harvesting have an influence on the longevity of the seed and the seed-borne fungi. It has been noted that samples of seed contaminated with species of Chaetomium lose their germinability more rapidly than those not so contaminated.

There is a differential longevity of pea seed and seed-borne Ascochyta pisi to the point of elimination of the fungus without much loss of germinative capacity of the seed after cool dry storage for 5 to 7 years. This fact provides for the first time a practical method of control for the leaf and pod spot disease in cases where the source of infection is seed-borne.

Pea seed that does not qualify for foundation status because of high infection with A. pisi may now be held in storage for subsequent certification.

Confirmation has been obtained of the beneficial effects derived from treating aged pea seed.

The author wishes to express his appreciation to Miss A. Wallace and Mr. W. Bell for technical assistance with this problem.

Literature Cited

1. Coons, G. H. 1923. Celery blight or leaf spot. Michigan Agr. Exp. Sta. Quart. Bull. 5: 190-193.
2. Crocker, W. 1945. Longevity of seeds. Jour. New York Botanical Garden 46: 542: 26-35.
3. Crosier, W. 1939. Occurrence and longevity of Ascochyta pisi in seeds of hairy vetch. Jour. Agr. Res. 59: 683-697.
4. McKee, R., and H. A. Schoth. 1934. Vetch culture and uses. U. S. Dept. Agr. Farmers' Bull. 1740.
5. Wallen, V. R., A. Wallace, and W. Bell. 1955. Response of aged vegetable seed to seed treatment. Plant Dis. Reptr. 39: 115-117.
6. Wilson, J. D., and A. G. Newhall. 1930. The control of celery blights. Ohio Agr. Exp. Sta. Bull. 461.

BOTANY AND PLANT PATHOLOGY LABORATORY, SCIENCE SERVICE, CANADA DEPARTMENT OF AGRICULTURE, OTTAWA, ONTARIO

FUMIGATION OF BELL PEPPER SEED BEDS FOR CONTROLLING DAMPING-OFF CAUSED BY RHIZOCTONIA SOLANI

W. J. Martin, N. L. Horn, and John A. Cox[1]

SUMMARY

Experiments and observations over a 3-year period on the use of methyl bromide fumigation for controlling damping-off due to Rhizoctonia solani Kuehn in bell pepper beds in Louisiana have demonstrated the usefulness of this method, and pointed out limitations in one case. One pound of Dowfume MC-2 per 100 square feet appeared to give effective control and as good control as 2 pounds per 100 square feet. Weed control was excellent with either treatment. The cost of the treatment appeared to be less than the cost of labor for weeding beds.

INTRODUCTION

Bell pepper growers in Louisiana annually experience losses, due to damping-off caused by Rhizoctonia solani, in their seed beds during December and January. Weather conditions during that time frequently are ideal for the development of the disease and it is not uncommon to find complete loss of plants in some beds. Although chemical treatment of seed and soil have reduced such losses, the fungicides previously recommended have been inadequate for good control under conditions extremely favorable for development of damping-off. For that reason investigations were started in 1952 to determine the effectiveness of fumigation of seed beds with methyl bromide to control damping-off.

MATERIALS AND METHODS

All the fumigation was done under gas-proof plastic covers ("Visqueen"). The methyl bromide used was Dowfume MC-2 (2% chloropicrin and 98% methyl bromide) contained in 1-pound cans. The methyl bromide was released by means of a "jiffy" applicator under the covers, which were sealed along the edges with soil. Exposures varied from 40 to 48 hours because of the comparatively low soil temperatures (below 60° F). In all cases after the 1952-53 experiment, the bed borders (mostly made of lumber) were covered and treated in all treated plots. All plots were 100 square feet in area except those in the Tangipahoa experiment. The latter were 50 square feet.

EXPERIMENT IN 1952-53

This was largely an exploratory experiment in St. James Parish, Louisiana and consisted of three replicates of fumigated versus unfumigated plots. The fumigated plots received 2 pounds of methyl bromide per 100 square feet. The soil was in good physical condition at time of treating and soil moisture was ideal for planting. Soil temperature was 49° F and for that reason the plastic covers were not removed for a period of about 40 hours. The beds were fumigated on December 15, 1952, and planted 12 days later. Little or no damping-off developed in either treated or untreated plots in this experiment. However, on February 13, 1953, when plants were almost ready for the field, the plants in treated plots appeared more vigorous than those in untreated plots. Weed control was excellent in the treated plots.

EXPERIMENT IN 1953-54

This experiment was made in St. James Parish in Sharkey clay loam soil. The soil was in good tilth at the time of treatment on December 21, 1953. Soil moisture was ideal for planting and soil temperature at a depth of 6 inches was 56° F. The fumigation was over a period of about 48 hours. The experiment consisted of four replicates of untreated and treated areas in two different beds. The treated areas received 2 pounds of Dowfume MC-2 per 100 square feet of bed. The beds were seeded with California Wonder variety on December 29, 1953. By

---

[1] Plant Pathologist, Assistant Plant Pathologist and Extension Horticulturist, respectively at Louisiana State University. Acknowledgment is hereby made to Joseph Lamendola, formerly County Agent in St. James Parish, Louisiana for assistance in locating sites for the early tests.

Table 1. Mean[a] number of bell pepper plants, diseased bell pepper plants, and nutgrass plants per square foot of bed in methyl bromide treated and untreated plots in 1953-54 in St. James Parish, Louisiana.

Mean no. per square foot of:	Treated	Untreated	L.S.D. 1%
Bell pepper plants	52.13	38.50	4.63
Diseased bell pepper plants	0.19	7.38	4.55
Nutgrass plants	0.00	7.25	2.75

[a] Mean of 4 different square foot areas in each of 4 replicates of each treatment.

Table 2. Mean[a] number of healthy pepper plants and of plants affected by damping-off in methyl bromide-treated and untreated plots in St. James Parish, Louisiana, January 25, 1955.

Treatment	Healthy plants	Percent affected with damping-off
Untreated	115.0	14.08
1 pound Dowfume MC-2 per 100 square feet	190.9	0.12
2 pounds Dowfume MC-2 per 100 square feet	199.4	0.22
L.S.D. 5%	38.73	7.58
L.S.D. 1%	52.26	10.23

[a] Mean of 3 counts of square foot areas taken at random in each of 3 replicates.

January 26, 1954, the plants had emerged to a good stand and damping-off was beginning to appear. Counts were made of the total number of plants, the number of diseased plants, and the number of nutgrass plants in four different square foot areas at random in each plot. The results of these counts are given in Table 1.

The results in Table 1 show the excellent control of damping-off and nutgrass plants. Although no data are presented here, broadleaf weeds also were controlled in the treated plots.

The superior stand and height of the plants in a treated compared to an untreated area in this experiment are illustrated in Figure 1. The photograph was made in late February.

A soil sample from the untreated plots in the bed was screened for plant parasitic nematodes on March 8, 1954. The following nematodes were recorded per pint of soil: Tylenchorhynchus sp., 780; Helicotylenchus sp. 40.

EXPERIMENTS IN 1954-55

Two experiments were made, one on Sharkey clay loam soil in St. James Parish and one on a lighter soil type in Tangipahoa Parish. The former will be discussed first.

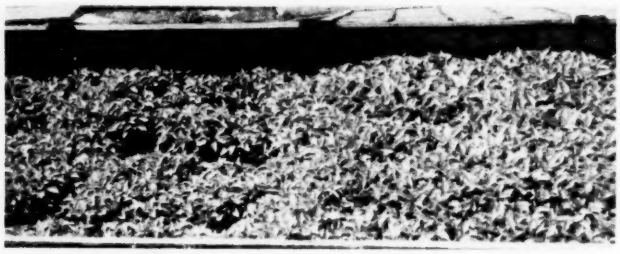


FIGURE 1. Bell pepper plants in a treated (right) and untreated (left) area in methyl bromide-fumigation experiment in 1953-54.

Experiment No. 1. This experiment consisted of three replications of each of the following three treatments: 1) Untreated, 2) treated with Dowfume MC-2 at the rate of one pound per 100 square feet, and 3) treated with Dowfume MC-2 at the rate of 2 pounds per 100 square feet. The plots were treated on December 21, 1954, and seeded with California Wonder variety of peppers on December 28, 1954. Soil was in good tilth and moisture at the time of treating. Soil temperature was 52° F at a depth of 6 inches. The fumigation period was approximately 40 hours. On January 26, 1955, plant counts were made as summarized in Table 2, which indicates the striking control of damping-off resulting from the treatments.

Soil samples from the untreated plots in two beds used in this experiment were screened for determination of plant parasitic nematodes at the time of treatment. From one of the beds, the following nematodes were recorded per pint of soil: Tylenchorhynchus sp. 90, and Helicotylenchus sp. 20. From the other bed the following were recorded per pint of soil: Helicotylenchus sp. 10, Pratylenchus sp. 30.

Experiment No. 2. This experiment consisted of three replications of each of the three treatments reported in the above test. However, two of the three plots of the treatment involving 1 pound of Dowfume MC-2 per 100 square feet showed a very severe toxic reaction, presumably due to the treatment. Because of this toxicity, which is discussed below, only two of the treatments were considered for their effect on damping-off control, namely, the untreated check and the plots treated with 2 pounds of Dowfume MC-2 per 100 square feet. The plots were treated on December 16, 1954. The soil was in excellent condition for treating. Soil temperature at a depth of 6 inches was 57° F. The fumigation lasted for 42 hours.

On January 31, 1955, damping-off was prominent in some of the beds and data were taken as recorded in Table 3. The data show very effective control of damping-off. In addition there was very good weed control in the treated plots.

Soil samples, taken from untreated plots in 3 beds used in this experiment, were screened for determination of plant parasitic nematodes. The following nematodes were recorded per pint of soil on December 17, 1954.

Soil sample	Xiphinema	Helicotylenchus	Pratylenchus	Meloidogyne	Criconemoides
1	0	720	90	50	20
2	40	200	40	30	0
3	60	320	110	90	40

The only case of toxicity observed by the authors occurred in this experiment. The effect of the 1-pound rate of Dowfume MC-2 in this test was so severe that only a few plants emerged. Six weeks after treatment pepper plants grew normally in the same soil. A possible explanation

Table 3. Mean[a] number of healthy pepper plants and of plants affected with damping-off in methyl bromide-treated and untreated plots in Tangipahoa Parish, Louisiana on January 31, 1955.

Treatment	Healthy plants	Percent affected with damping-off
Untreated	49.00	49.12
2 lbs. Dowfume MC-2 per 100 square feet	197.83	0.00
L.S.D. 5%	60.21	20.55
L.S.D. 1%	85.12	29.05

[a] Mean of 3 counts of square foot areas taken at random in each of 3 replicates.

of this toxicity might be found in Thiegs' report[1] on the balance between ammonia and nitrate nitrogen. It should be noted, however, that the 2-pound rate in another bed which was included in this test and which occurred on the same farm, resulted in no toxicity. The plants grew vigorously. Damping-off and weeds were controlled.

The fact that methyl bromide fumigation has been used very successfully at a number of locations over a 3-year period, makes it even more urgent to emphasize the possibility of a severe toxic reaction under certain rather obscure soil conditions. However, at the present time the authors believe that the odds are much greater that damping-off will cause loss of bell pepper plants than that methyl bromide treatments will do so, under present conditions in the commercial areas in Louisiana.

LOUISIANA STATE UNIVERSITY, BATON ROUGE, LOUISIANA

[1] Thiegs, B. J. 1955. Effect of soil fumigation on nitrification. Down to Earth. 11: 14-15.

A PHYTOPHTHORA DAMPING-OFF DISEASE OF SOYBEAN

C. B. Skotland

In May 1954, pre-emergence and post-emergence damping-off of soybean, Glycine max (L.) Merrill, was prevalent in some fields of the variety Ogden in North Carolina. In addition to Fusarium spp., Pythium spp., and Rhizoctonia sp., a slow growing fungus closely resembling species of the genus Phytophthora, not heretofore reported as an incitant of damping-off on this crop, was isolated from diseased seedlings. The results of etiological and preliminary morphological studies of the Phytophthora-like organism are herein reported.

This fungus produced typical damping-off symptoms on soybeans. Oospores of the fungus were readily found in infected host tissues. This fungus was isolated from plants from two widely separated areas in 1954. During the spring of 1955 it was not found nor were damping-off diseases of soybeans prevalent in North Carolina.

The Odgen soybean variety was used in pathogenicity tests. Inoculum was prepared by growing the fungus on sterilized soybean seeds in water for 6 to 8 days at 25° C. The fungal mat was separated from the seeds and macerated in a Waring Blendor for 5 seconds. The larger particles were allowed to settle and the suspended mycelial fragments decanted. This inoculum was diluted 1:10 and poured onto wet soil in 6-inch clay pots. Fifteen soybean seeds were placed in each pot and covered with moist soil. Pots were not watered until seedlings had begun to emerge. Tests were conducted in both steamed and unsteamed soil at temperatures of 18°, 24°, and 27°-30° C. Four replications were used of each soil and the several temperatues.

The fungus was found to incite both pre-emergence and post-emergence damping-off at each temperature. Two replicates of the test conducted at 27°-30° C are shown in Figure 1. In the infested steamed soil 170 seedlings failed to emerge, 6 died from post-emergence damping-off, and 4 remained healthy. In the infested nonsteamed soil, 141 failed to emerge, 27 died soon after emergence, and 12 remained healthy. No post-emergence damping-off was observed in the uninoculated checks. However, 25 seeds, out of the 180 planted, failed to emerge in the steamed check and 35 seeds failed to emerge in nonsteamed check. The fungus in question was consistently reisolated from infected seedlings in both the pre-emergence and post-emergence stages of damping-off. Oospores were readily found in the infected plant tissue. These isolates

FIGURE 1. Two replicates of pathogenicity test conducted at 27°-30° C.

were identical to the original. Reinoculations with these isolates reproduced the disease.

The fungus was grown on three standard media at different temperatures. The daily linear growth was measured on Difco cornmeal agar, Difco potato dextrose agar, and laboratory prepared oatmeal agar in growth tubes at 20°, 24°, 28°, and 32° C. Best growth occurred on oatmeal agar at 24°. One of the distinguishing characteristics of this fungus was its slow growth. The results of these tests are summarized in Table 1.

Several morphological characters of the fungus were studied. The mycelium was coenocytic and ranged from 3 to 5 μ in diameter. No sporangia formed in the three agar cultures; however, when wefts of mycelium were placed in Petrie's[1] solution for 6 to 8 hours at 25° C sporangia

[1] Petrie's mineral solution: calcium nitrate, 0.4 g.; magnesium sulphate, 0.15 g.; potassium acid phosphate, 0.15 g.; potassium chloride, 0.06 g.; water, 1000 cc.

Table 1. Effect of temperature and medium on the daily linear growth of Phytophthora sp. causing damping-off of soybean.

Medium	Growth at indicated temperature (°C).			
	20°	24°	28°	32°
	mm.	mm.	mm.	mm.
PDA[a]	2.70	3.50	2.55	1.75
CM[a]	4.20	5.00	3.06	1.85
Oatmeal agar	6.35	9.40	7.85	6.80

[a] Difco dehydrated media.

and zoospores were produced. Sporangia were usually pyriform and non-papillate, occasionally ovate, and internal proliferation was noted. Sporangia were 16 to 32 μ in width and 35 to 48 μ in length. Five to 20 zoospores were delimited within each sporangium and emerged through the apical end. No vesicle was observed. Encysted zoospores were approximately 13 μ in diameter and germinated directly. Sexual organs formed readily in culture and within host tissues. Measurements were made of sexual structures produced on water agar. Oogonia ranged from 29 to 42 μ in diameter. The diameter of oogonia and oospores produced on water agar ranged from 29 to 42 μ and 23 to 32 μ respectively. Oospores were smooth, spherical, and aplerotic. The oospore wall ranged from 2.5 to 3.0 μ in thickness. Most antheridia were diclinous, with a few monoclinous. Usually only one paragynous type antheridium was attached to an oogonium. These characteristics indicate that this pathogen belongs in the genus Phytophthora, and resembles P. cactorum (Leb. & Cohn) Schroet.

FIELD CROPS RESEARCH BRANCH, AGRICULTURAL RESEARCH SERVICE, U. S. DEPARTMENT OF AGRICULTURE AND NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION CO-OPERATING, RALEIGH, NORTH CAROLINA

EFFECT OF ANTIBIOTICS ON THE GROWTH OF TILLETIA CARIES[1]

R. W. Newburgh[2] and Vernon H. Cheldelin[3]

Certain plant diseases can be controlled with antibiotics, and it seemed desirable to determine if antibiotics would inhibit the growth in culture of Tilletia caries, a fungus causing bunt (stinking smut) of wheat.

The culture medium used was reported previously[4]. The oligomycin was donated by Dr. W. H. Peterson, University of Wisconsin; the other antibiotics by Merck and Co., Inc.

Each flask containing 100 ml of medium and the appropriate antibiotic was inoculated with 3 ml of 3-day-old cultures of fungus. The flasks were placed on a rotary shaker for 4 days and the dry weight of the smut fungus then determined. Each test was run at least in triplicate.

Table 1. The inhibition of the in vitro growth of Tilletia caries by certain antibiotics.

Antibiotic	µg/ml of medium						
	0.025	0.10	0.4	0.5	1.0	1.5	2.0
	Percent inhibition						
Oligomycin	30	70	100	100	-	100	
Pleocidin	-	-	0	-	60	80	
Fungichromin	-	-	-	0	0	10	30
Penicillin	-	-	-	0	25	-	50
Bacitracin	-	-	-	0	10	-	50
Cathomycin	-	-	-	0	0	-	0
Oxamycin	-	-	-	0	0	-	40
Neomycin	-	-	-	0	30	-	60
Candicinin	-	0	-	8	50	-	90
Streptomycin	-	-	-	0	-	-	50

Table 1 shows the effect of different concentrations of the antibiotics in inhibiting the growth of the fungus. Oligomycin was the most effective antibiotic tested.

The antibiotics that were effective in vitro should be tested on wheat to determine their ability to control bunt.

AGRICULTURAL RESEARCH SERVICE, U. S. DEPARTMENT OF AGRICULTURE, AND OREGON STATE COLLEGE, CORVALLIS, OREGON

[1] Published with the approval of the Monographs Publications Committee, Oregon State College, School of Science, Department of Chemistry.

[2] Field Crops Research Branch, Agricultural Research Service, United States Department of Agriculture.

[3] Science Research Institute and Department of Chemistry, Oregon State College, Corvallis, Oregon.

[4] Newburgh, R. W., C. A. Claridge, and Vernon Cheldelin, 1955. Jour. Biol. Chem. 214: 27.

ADDITIONAL GRASS HOSTS AND A REVISED HOST LIST FOR DWARF BUNT

J. R. Hardison[1], H. S. Fenwick[2], and J. P. Meiners[3]

According to Conners (1) the smut fungus[4] causing dwarf bunt in North American grasses and cereals is the same as the fungus in Europe and Asia causing dwarf bunt in Agropyron cristatum (L.) Gaertn., A. intermedium (Host) Beauv., A. repens (L.) Beauv., A. rigidum var. tomentosum Regd, and A. orientale, in addition to the cereals, Secale cereale L., Triticum aestivum L. and T. spelta L.

Dwarf bunt was originally described on wheat, Triticum aestivum, in Montana (8), and the disease has now been found at several other locations in the United States and in Canada (1). Fischer (3) reported the disease in Agropyron intermedium and A. subsecundum (Link) Hitch. from Idaho. Susceptibility of rye, Secale cereale, was reported from Utah by Woodward et al. (7), and dwarf bunt was found on rye in Oregon in 1953 and 1954. In 1954, approximately 1 percent of the rye plants in a field were smutted, and numerous volunteer wheat plants growing among the rye plants also were infected.

FIGURE 1. Healthy (left) and dwarf bunt-infected (right) inflorescences in each of four grasses.

In Oregon, dwarf bunt was found in Agropyron intermedium in 1952 (6), and in Agropyron elongatum (Host) Beauv. in 1953 (5). In July 1954, dwarf bunt was found in Agropyron cristatum and A. desertorum (Fisch.) Schult. (Fig.1) in an eastern Oregon grass nursery planted in

---

[1, 2] Pathologist, Field Crops Research Branch, Agricultural Research Service, U. S. Department of Agriculture, and Department of Botany and Plant Pathology, Oregon Agricultural Experiment Station; and Graduate Research Assistant, Oregon Agricultural Experiment Station, respectively. Assistance of Dr. George W. Fischer with some of the identifications and of Mr. George Crowley with nursery plantings in Oregon is gratefully acknowledged.

[3] Agent (Pathologist), Field Crops Research Branch, Agricultural Research Service, U. S. Department of Agriculture in cooperation with the Washington, Idaho and Oregon Agricultural Experiment Stations.

[4] The dwarf bunt organism has been variously designated under the specific epithets, Tilletia brevifaciens G. W. Fischer, T. caries (DC) Tul., T. contraversa Kuehn, T. tritici (Bjerk.) Winter, and T. tritici nanifica Wagner. Because there is no consensus on any one of these designations, no specific epithet is applied to the dwarf bunt organism in this paper.

a field with a past history of dwarf bunt infection in grasses and wheat. Dwarf bunt was found in the above two grass species and also in Agropyron sibiricum (Willd.) Beauv. growing in a similar nursery planted at Worley, Idaho, in soil having a history of this disease in wheat. Apparently dwarf bunt infection has not previously been reported in A. cristatum in North America, and A. desertorum and A. sibiricum represent new hosts for the fungus.

The dwarf bunt infection found in 1952 in tall oatgrass, Arrhenatherum elatius (L.) Presl. (6), represented the first report of the disease in a grass outside the tribe Hordeae. Infection of Festuca rubra L. found in 1953 (5) extended the known host range to the tribe Festuceae. In July 1954, Dactylis glomerata L., a new host species in the tribe Festuceae, was found infested with dwarf bunt in the eastern Oregon test nursery (Fig. 1).

Possible infection of Agropyron trichophorum (Link) Richt., Festuca arundinacea Schreb., F. ovina var. duriuscula (L.) Koch, and Poa pratensis L. has been suggested (5), because bunt spore balls were found in seed samples. However, dwarf bunt-infected plants of these grasses have not been observed. Dwarf bunt is found occasionally among spore balls in seed samples of different grasses produced in eastern Oregon. Most of these smut balls contain spores morphologically similar to those of common bunt (T. caries (DC.) Tul.). However, they differ physiologically, because they require low temperatures for germination. Further study of this material suggests that the majority of the smut balls originate from bunt in weedy annual brome grasses, especially Bromus tectorum L. Bunt on this grass has been ascribed by Fischer (2) to T. caries.

HOST RANGE OF THE DWARF BUNT FUNGUS

Using the host lists compiled by several authors and the data in the present paper, the host range of dwarf bunt[4] includes the following:

Host species	Locality and Reference
TRIBE HORDEAE	
Agropyron cristatum	Caucasus (1)[a], Oregon[b], Idaho[b]
A. desertorum	Oregon[b], Idaho[b]
A. elongatum	Oregon (5)
A. intermedium	Caucasus and Europe (1), Idaho (3), Oregon (6)
A. orientale	Caucasus (1)
A. repens	Europe (1)
A. rigidum var. tomentosum	Turkestan (1)
A. sibiricum	Idaho[b]
A. subsecundum	Idaho (3)
Secale cereale	Germany (1), Utah (7), Oregon[b]
Triticum aestivum	Europe, Canada, United States (1, 4)
T. spelta	Germany (1)
TRIBE AVENEAE	
Arrhenatherum elatius	Oregon (6)
TRIBE FESTUCEAE	
Dactylis glomerata	Oregon[b]
Festuca rubra	Oregon (5)

[a] Conners referred his material to Tilletia contraversa.
[b] Present paper.

Fischer[5] suggested that the bunt found in seed samples of Merion bluegrass, Poa pratensis, produced in Union County, Oregon, likewise most closely resembled the bunt common on Bromus tectorum, that is T. caries. In 1954, this bunt was very prevalent on B. tectorum, which occurred commonly as a weed in many of the grass seed fields and was even prevalent in some cultivated row plantings.

T. fusca Ell. & Ev. on weedy annual Festuca spp. and T. guyotiana Hariot on certain annual Bromus spp. also are present in the problem area, and their spore balls likewise are intermixed with harvested grass seeds. Finally, spore balls of dwarf bunt and of the common bunts, T. caries and T. foetida (Wallr.) Liro, produced in the Agropyron spp. could be intermixed with the weed grass smuts, thus providing a possible association of spore balls of several different bunt fungi in harvested seed of various grasses.

Literature Cited

1. Conners, I. L. 1954. The organism causing dwarf bunt of wheat. Canadian Jour. Bot. 32: 426-431.
2. Fischer, George W. 1950. Spontaneous occurrence of Tilletia caries (T. tritici) on seven new grass hosts. Abstract. Phytopath. 40: 9.
3. _____. 1952. Tilletia brevifaciens sp. nov., causing dwarf smut of wheat and certain grasses. Research Studies of the State College of Washington 20, No. 1: 11-14.
4. _____. 1953. Manual of the North American Smut Fungi. The Ronald Press Co., New York. 343 pp.
5. Hardison, John R. 1954. New grass host records and life history observations of dwarf bunt in Eastern Oregon. Plant Dis. Reptr. 38: 345-347.
6. _____, and Malcolm E. Corden. 1952. A serious outbreak of dwarf bunt in tall oatgrass in Oregon. Plant Dis. Reptr. 36: 343-344.
7. Woodward, R. W., C. S. Holton, and O. A. Vogel. 1952. Dwarf bunt in rye. Plant Dis. Reptr. 36: 434.
8. Young, P. A. 1935. A new variety of Tilletia tritici in Montana. (Abstract) Phytopath. 25: 40.

FIELD CROPS RESEARCH BRANCH, AGRICULTURAL RESEARCH SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE; AND THE OREGON, IDAHO, AND WASHINGTON AGRICULTURAL EXPERIMENT STATIONS

[5] In correspondence.

CLASSIFICATION OF SORGHUM CULMS BEARING HEADS INFECTED WITH SPHACELOTHECA SORGHI

R. H. Porter[1]

In a recent paper[2] data were given on the control of covered smut (Sphacelotheca sorghi (Lk.) Clint.) of sorghum, using 16 treatments on the varieties Sharon kafir and Rancher sorgo. It was shown that only Phygon gave nearly complete control of smut on Rancher sorgo, which is a variety with persistent glumes surrounding the seed. While making the readings for smut incidence it was noted that many culms bearing smutted heads were lodged or stunted, and that not infrequently only suckers from a plant were smutted or only the main culm of a plant was smutted with suckers remaining free. A count was therefore made to classify the culms bearing smutted heads in the three replications. The classes were: total smutted heads, smutted heads on lodged or stunted culms, main culm smutted with suckers free, and suckers smutted with the main culm free. Table 1 shows the results of the observations by treatments from the three replications.

Table 1. Classification of culms of Rancher sorgo bearing heads infected with Sphacelotheca sorghi at Fort Collins, Colorado, 1954.

Treatment	Total heads smutted	Smutted heads on lodged culms	Smutted heads on suckers	Smutted heads on stunted culms	Main culm smutted, suckers free	Suckers smutted, main culm free
1. Check	67	8	44	26	15	5
2. Panogen, liquid	16	2	14	9	2	2
3. Dupont 244 "	3	0	2	2	1	1
4. Dupont 364 "	31	3	12	16	3	4
5. Setrete "	41	10	24	22	10	7
6. Merculine "	18	0	5	9	3	5
7. Mema "	54	14	42	35	12	11
8. Mergamma, slurry	38	8	27	26	8	7
9. Agrox "	31	8	25	18	6	5
10. Check	48	9	34	34	12	10
11. Puraseed, slurry	16	3	10	6	5	1
12. Pura C-14-66 "	52	4	39	31	10	7
13. Orthocide "	35	3	26	23	7	5
14. Ethyl 856-I "	65	17	40	29	12	9
15. Arasan SFX "	20	4	16	15	4	6
16. Spergon "	20	5	16	14	3	1
17. Phygon "	0	0	0	0	0	0
18. Copper carbonate "	28	2	23	17	5	7
Totals	583	100	399	332	118	93
Percent of total		17.1	68.4	56.9	20.2	15.9

The Table shows that 17 percent of the smutted heads were on lodged culms most of which were suckers and almost prostrate. This suggests that the pathogen may have weakened the

[1] Plant Pathologist, Colorado Experiment Station, Fort Collins.

[2] Leukel, R. W., O. J. Webster, and R. H. Porter. 1954. Sorghum seed-treatment tests in 1954. Plant Dis. Reptr. 38: 769-770.

culms because very few non-smutted culms were lodged. In the last two columns of the Table it may be noted that 20 percent of the smutted culms were on main culms with the suckers free and, further, that about 16 percent of the smutted culms were on suckers from plants with the main culms free. The high percentage of smutted heads on stunted culms (56.9 percent) is of particular interest because practically all of them were suckers, which grew late in the season and were less mature than those of normal height. Not all suckers from a given plant were smutted, but in many instances the pathogen apparently is able to remain in the crown and grow into a sucker as it develops. Temperature no doubt influenced the development of the fungus.

It must be borne in mind that lodged culms were often stunted, and since they were usually suckers a given culm could appear in at least three classes. If the totals of smutted heads on suckers and on main culms with suckers free are added they account for 88.6 percent of the culms with smut. The balance of 11.4 percent would be those cases in which main culms and some of their suckers were smutted.

In those cases involving treatments where only suckers (last column of Table) were smutted may it not be possible that the fungicide checked the development of the fungus during early growth but was not sufficiently toxic to prevent the fungus from growing into the suckers? Another possibility is that the temperature was more favorable for the smut fungus later than in the early development of the plant. Suckers form on sorghum at various stages of plant development. The objection to the suggested possibility of variation in the toxicity of the fungicide is that in rows planted with non-treated seed the percentage of cases where only suckers were smutted is not much different than in rows planted with treated seed. No reason is suggested for the opposite result as evidenced in column 6 in which smut appeared on the main culm but not on the suckers.

COLORADO AGRICULTURAL EXPERIMENT STATION, FORT COLLINS

A MEASUREMENT OF DISEASE REACTION OF COTTON TO VERTICILLIUM WILT

Eugene E. Staffeldt and Paul A. Fryxell[1]

Before 1954, cottons from Alabama, Arkansas, Arizona, California, Mississippi, and Texas, and some having African derivation were introduced, evaluated, and selected for Verticillium wilt (V. albo-atrum) tolerance under New Mexico conditions. This diverse germ plasm was graded for Verticillium wilt reaction primarily on a percentage basis. It was common to observe 95 to 100 percent wilted plants, regardless of treatment or strain in the breeding nursery; but at the end of the season, significant differences in yield were encountered which could be ascribed to disease reaction. Therefore, it was decided that percentage of infected plants was not adequate in determining the tolerance of cotton to Verticillium wilt under New Mexico conditions.

In 1954, a wilt tolerance grading scheme (Table 1) was devised. Two major considerations ultimately determined the grade. They were percentage of functioning photosynthetic area and external symptoms. Thus, a plant that exhibited 100 percent of functioning photosynthetic area and appeared healthy, with no external symptoms, was given a grade of 0. A plant with 90-99 percent functioning photosynthetic area, exhibiting slight leaf mottling and almost no defoliation, was graded as 1. The grade 2 was given a plant containing 50-89 percent functioning photosynthetic area resulting from moderate leaf mottling or appreciable defoliation or a combination of these two external symptoms. Grade 3 was assigned to a plant with 10-49 percent functioning photosynthetic area as a result of severe leaf mottling or a loss of more than one-half of the leaves or a combination of the two. A dead plant or one almost completely defoliated, exhibiting only 0-9 percent functioning photosynthetic area, was given a grade of 4.

Grading for wilt reaction in 1954 was accomplished on an individual plant basis. At most of the locations, only one grading was attempted. On two of the experiments, grades were assigned two or more times during the season. In three of the experiments, yield data were available, so that the correlation between disease grade and yield could be evaluated. These correlations were computed from varietal means and are given in Table 2. Experiments I and III were trials of 12 common strains, while Experiment II was a trial of 64 strains, two of which were common to all three experiments. The correlations are relatively large and consistent, indicating that the disease grading scale was measuring a variable effectively related to yield. There is also an indication that late-season disease rating is not so closely related to yield as is an earlier rating. It was possible to check this further in the case of Experiment II. Varietal components of variance and covariance were used to construct the varietal correlation coefficients. The values so obtained for the correlation between yield and disease grade were -.315 for September 20 and -1.08 for August 9. This further substantiates the conclusion that early-season gradings may be more useful.

The number of plants in the disease evaluations in 1954 varied from 15 plants per replication in the replicated experiment to 26 to 54 plants in the observational rows. In four of these experiments the same 12 entries were evaluated by one or the other of the authors. Close agreement was experienced in the alignment of the 12 entries referred to the Experiments I and III, although the levels of disease incidence varied from one experiment to another.

A refinement of the grading scheme was added for future use (Table 3). The noticeable symptom, stunting, was occasionally observed in 1954. Such stunted plants had their yield potential reduced but not all of them sustained extensive defoliation. The readings on such plants were subject to the discretion of the individual who evaluated these plants. Therefore an adjustment for stunting due to Verticillium wilt has been incorporated in order to have a uniform evaluation of cotton plants. This external symptom of stunting was divided into three main categories: 1--plants 3/4 of the normal height of a non-stunted plant of the same variety or greater, 2--1/2 to 3/4 the height of a non-stunted plant, and 3--1/4 to 1/2 the height of a non-stunted plant. Plants in the first category will receive the same grade as non-stunted plants of that variety based on percentage of functioning photosynthetic area. Plants 1/2 to 3/4 the height of non-stunted plants will receive one grade higher than that based on external symptoms. Thus a grade of 1 would be increased to a grade of 2, a grade of 2 would be increased to a grade of 3

---

[1] Assistant plant pathologist and assistant in agronomy, Agricultural Experiment Station, New Mexico College of Agriculture and Mechanic Arts, State College, N. M. This article is published with the approval of the director of the station as journal article 98.

Table 1. Method by which individual cotton plants were graded on the basis of external symptoms.

Percent of functioning photosynthetic area	External symptoms	Grade
100	Apparently healthy, no external symptoms	0
90-99	Slight leaf mottling, almost no defoliation	1
50-89	Moderate leaf mottling, appreciable defoliation	2
10-49	Severe leaf mottling, more than half of leaves dropped	3
0-9	Dead plant or almost complete defoliation	4

Table 2. Correlations, between Verticillium wilt disease grade and yield of cotton, in three experiments, by dates.

Experiment	Date on which disease grade was given			Person giving disease grade
	August 9	September 7	September 20	
I	-.781	-.789		Staffeldt
II	-.700		-.322	Fryxell
III	-.517			Staffeldt

Table 3. Proposed method by which individual cotton plants will be graded on the basis of external symptoms.

Percent of functioning photosynthetic area	External symptoms	Grade		
		Stunting (as height relative to non-stunted plants)		
		3/4 normal	1/2-3/4	1/4-1/2
100	Apparently heatlhy, no external symptoms	0		
90-99	Slight leaf mottling, almost no defoliation	1	2	3
50-89	Moderate leaf mottling, appreciable defoliation	2	3	4
10-49	Severe leaf mottling, more than half of leaves dropped	3	4	
0-9	Dead plant or almost complete defoliation	4		

and a grade of 3 would be increased to a grade of 4. Finally, plants 1/4 to 1/2 the height of non-stunted plants will receive two grades increase over that based on external symptoms. Thus a grade of 1 would be increased to a grade of 3 and a grade of 2 would be increased to a grade of 4.

NEW MEXICO COLLEGE OF AGRICULTURE AND MECHANIC ARTS, STATE COLLEGE, NEW MEXICO

SOME PREVIOUSLY UNRECORDED HOSTS OF VERTICILLIUM ALBO-ATRUM IN CALIFORNIA

Stephen Wilhelm, Robert D. Raabe, and Eugene B. Smalley[1]

Since the previous report of new hosts (5), the vascular fungus pathogen Verticillium albo-atrum Reinke & Berth. has been isolated from diseased plants of Rhaphiolepis indica Lindl. (India hawthorn), R. umbellata var. integerrima Rehd. (Yeddo hawthorn), commonly called R. ovata, Cistus purpureus Lam. (rock-rose), Cinnamomum camphora Nees & Eberm. (camphor tree), Vigna sesquipedalis W. F. Wright (Chinese yard-long bean), Rheum rhaponticum Linn. (rhubarb), Tetragonia expansa Thunb. (New Zealand spinach), Acer palmatum Thunb. (Japanese maple), and Catalpa sp., probably C. speciosa Warder. Verticillium wilt does not appear to have been reported previously in Rhaphiolepis, Cistus, Cinnamomum, the Chinese yard-long bean, or New Zealand spinach. The disease in rhubarb has been reported previously from New England (7) and Ireland (2). Catalpa speciosa and Acer palmatum are rather well-known hosts in the central and northeastern States (6).

Except for unconfirmed reports in pear (3) and apple (1), quince, reported by Wormald and Harris (8), and Rhaphiolepis are the only known hosts of Verticillium in the tribe Pomeae of the rose family. The wilt pathogen from Rhaphiolepis was isolated in culture from the vascular tissues of several affected plants growing in two different areas of the University of California campus, and in a private garden. The soil on the campus in which these plants were growing was topsoil fill used in landscaping a new area. Affected plants exhibited unilateral dying of branches, yellowing, browning and casting of lower leaves, and pronounced brown to black vascular discoloration. Ultimately, affected plants failed to make satisfactory growth and became unsightly.

Verticillium-affected Cistus has been observed under similar circumstances. Affected plants appeared straggly and stunted and died without the usual leaf drop.

The Verticillium disease appeared in a winter planting of Vigna sesquipedalis in the San Joaquin Valley. Affected plants 6 to 8 feet high, on poles, wilted, with yellowing of lower leaves, and a pronounced dark vascular discoloration. Verticillium isolates from this host were found to be pathogenic to Pearson tomato and cowpea.

Tetragonia expansa growing as an escape on old vegetable land showed pronounced yellowing and drying of the basal leaves. Isolations from the noticeably discolored vascular tissues yielded V. albo-atrum, which in inoculation tests was pathogenic to Pearson tomato.

Rhubarb in southern California, and in the Mt. Eden district of Alameda County, wilted and showed pronounced yellowing and marginal and interveinal necrosis of basal leaves. Some fields sustained heavy losses. Verticillium albo-atrum was isolated readily from vascular tissues of petioles of diseased plants.

Several camphor trees growing as garden and street trees in the San Francisco Bay area exhibited dead and dying branches. These showed pronounced dark brown vascular discoloration and yielded V. albo-atrum upon culturing. Though this is apparently an unreported host, the collection of Verticillium isolates of B. A. Rudolph, now in possession of the senior author, includes isolates from camphor obtained from diseased trees growing in the Santa Clara Valley.

Verticillium diseased plants of Acer palmatum from a nursery and of Catalpa from a private garden showed dying of individual branches, marginal and interveinal leaf necrosis, and pronounced vascular discoloration.

The isolates of Verticillium from the aforementioned hosts produced microsclerotia in culture, especially when grown on natural straw media. Single spore analysis yielded the parent microsclerotial types and the conspicuous white mycelial (typically non-sclerotial) types, characteristic of the cosmopolitan species V. albo-atrum, the first individual of which was described by Reinke and Berthold in 1879 (4).

Literature Cited

1. Atanasoff, D., et al 1932. (Parasitic fungi new to Bulgaria. Third contribution). Yearbook Univ. of Sofia Fac. of Agr., Sofia, 10: 341-366. (Abstract in Rev. Appl. Mycol. 11: 745-746. 1932).

---

[1] Associate Professor, Assistant Professor, and Research Assistant, respectively.

2. McKay, R. 1945. Outbreaks of Verticillium wilt in newly erected glasshouses. Gard. Chron. Ser. 3, 117: 24.

3. Montemartini, Luigi. 1935. Arrossamento parziale della chima in peri: tracheoverticilliosi locale. Note di Fitopat. 9, Riv. di Pat. Veg. 25: 4-6.

4. Reinke, J., and G. Berthold. 1879. Die Zersetzung der Kartoffel durch Pilze. Untersuchungen aus dem Botanischen Laboratorium Universität Göttingen 1: 1-100.

5. Snyder, William C., H. N. Hansen, and Stephen Wilhelm. 1950. New hosts of Verticillium albo-atrum. Plant Dis. Reptr. 34: 26-27.

6. Weiss, Freeman. 1950-1953. Index of plant diseases in the United States. U. S. Department of Agriculture, Plant Dis. Survey Spec. Pub. 1.

7. Wormald, H. 1929. Rhubarb wilt. Ann. Rept. East Malling Res. Sta. 1928: 100.

8. Wormald, H., and R. V. Harris, 1937. Verticillium wilt of quince stocks. Ann. Rept. East Malling Res. Sta. 1936: 189.

DEPARTMENT OF PLANT PATHOLOGY, UNIVERSITY OF CALIFORNIA, BERKELEY, CALIFORNIA

SOME NEW PLANT DISEASE RECORDS FOR VIRGINIA

C. W. Roane and S. B. Fenne[1]

During the current season the following plant diseases were found and are reported for the first time in Virginia.

Speck Rot of Potato Caused by Stysanus stemonitis: In March, a sample of potatoes having symptoms similar to those of cold injury was submitted to our laboratory from Page County. Conidia borne on synnemata typical of Stysanus stemonitis appeared on the surfaces of cut potatoes held a few days in a moisture chamber. The fungus and the disease caused by it have not been reported previously from Virginia and, apparently, have been recognized only a few times in the United States. Therefore, the fungus was isolated and cultures have been deposited in the National Fungus Collections at Beltsville, Maryland, under accession number 71623. Cultures are available from the writers. Damage, in this case, was restricted to the crop from a single farm garden. A description of the disease is given by Chupp (2).

Downy Mildew of Small Grains: Distorted plants of Wong barley, Arlington oats, and Seneca wheat submitted to our laboratory from Henrico County were found to contain large brown oospores of Sclerospora macrospora imbedded in leaf tissues and floral organs. A single 37-acre field of river bottom land subject to spring floods, which was sown with a mixture of wheat, oats, and barley, was involved. It is estimated that 40 percent of the grain was destroyed.

Barley Leaf Spot of Undetermined Cause: A field of Wong barley being produced as the first crop on cleared land in Bedford County contained circular patches of plants showing leaf spotting unlike any previously observed by the writers. The spots were linear to circular and from 0.1 to 10.0 mm. in size. The linear and the small circular lesions were entirely chocolate brown, but the elliptical and large circular lesions had light centers with brown margins. The leaf blades died shortly after the heads emerged. Tiny spots appeared on the leaf-sheaths but the sheaths remained green long after the blades had died. Stunting of affected plants was most severe at the centers of the damaged areas and diminished gradually toward the perimeter until the symptoms were invisible. The spots on the leaves were similar to those shown by Christensen (1, fig. 4C) following inoculation of a Black Hull-less selection with Helminthosporium sativum. H. sativum, however, was not prevalent in the field referred to above. The distribution of the disease in the field suggested that the plants were absorbing from the soil a toxic residue produced by the woodland flora.

Two New Tree Diseases: Yellow leaf blister of Lombardy poplar (Populus nigra var. italica) caused by Taphrina populina Fr. was collected at Long Shop in Montgomery County. A Peridermium stage of needle rust of loblolly pine (Pinus taeda) was collected at Waynesboro in Augusta County. J. A. Stevenson identified the fungus as Colesporium laciniariae Arth. and stated that it is known to occur in New Jersey and Georgia but not in Virginia[2].

In addition to the diseases cited above as being new to Virginia, soil-borne wheat mosaic (Marmor tritici McKinney) was observed in Accomac County for the first time in 1954 and again in 1955. Mosaic was present in the wheat yield tests at the Onley field station of the Virginia Truck Experiment Station, both years, and was observed in Tetrapetkus and other rye varieties at this same location in 1955. Wheat is not commonly grown on the Eastern Shore but rye is grown there extensively as a green manure crop, and also in other parts of Eastern Virginia. This probably accounts for the extreme severity of soil-borne mosaic in many fields of that section. Mosaic is known to occur in 12 other counties of Virginia (5).

Corn stalk rot caused by Pythium butleri Subr. occurred in Mathews County in July 1955. Hybrids Ohio C-54 and Southern States Pocahontas were attacked. At this time no estimate of the damage is available. Previously, this disease had been reported on corn from Arlington, Dinwiddie, Nelson, and Northampton Counties (3, 4).

---

[1] Associate Plant Pathologist, Agricultural Experiment Station, and Plant Pathologist, Agricultural Extension Service, Virginia Polytechnic Institute. The writers wish to acknowledge the help of J. A. Stevenson of the National Fungus Collections, Beltsville, Maryland, in identifying certain fungi and providing information on their occurrence.

[2] Correspondence with S. B. Fenne.

Literature Cited

1. Christensen, J. J. 1934. Nonparasitic leaf spots of barley. Phytopath. 24: 726-742.
2. Chupp, C. 1925. Manual of vegetable-garden diseases. MacMillan Co. New York. 647 pp.
3. Elliott, Charlotte. 1943. A Pythium stalk rot of corn. Jour. Agr. Res. 66: 21-39.
4. Roane, C. W. 1950. Observations on corn diseases from 1947 to 1950. Plant Dis. Reptr. 34: 294-296.
5. _____, T. M. Starling, and H. H. McKinney. 1954. Observations on wheat mosaic in Virginia. Plant Dis. Reptr. 38: 14-18.

DEPARTMENT OF PLANT PATHOLOGY AND PHYSIOLOGY, VIRGINIA POLYTECHNIC INSTITUTE, BLACKSBURG, VIRGINIA

UNUSUAL RECORDS OF PLANT DISEASES

MICROSTROMA TONELLIANUM ON SWEET CHERRIES

By Paul L. Lentz

Microstroma tonellianum Ferr. (1914) was originally described as growing on plum leaves in Italy. Later (Ciferri, 1922) it was reported to cause a disease of plum leaves and (Bergamaschi, 1931) was also found to cause lesions on plum fruits. Diehl (1951) reported a very similar fungus on peach leaves in South Carolina, but he was not absolutely certain that this peach fungus was the same species as the plum fungus.

In early June, 1955, Dr. E. F. Guba, University of Massachusetts Field Station, Waltham, Mass., forwarded six diseased cherry (Prunus avium L.) fruits for examination at the National Fungus Collections. When lesions of the fruits were examined under low magnification, numerous minute pad-like fungus eruptions were seen. When sections of this material were examined, the characteristic melanconiaceous structure of M. tonellianum was recognized. The basidium-like, multisterigmate conidiophores were especially distinctive. The abundance of fruiting bodies on the lesions, together with reports of the pathogenicity of this fungus on plum fruits, indicates that M. tonellianum is probably pathogenic on cherry fruits.

This appears to be the first report of this fungus on cherries and, unless Diehl's peach fungus is the same species, the first report of this fungus in North America.

Literature Cited

1. Bergamaschi, M. 1931. Una nuova malattia dei frutti del susino. Atti Ist. Bot. Univ. Pavia (ser. 4) 2: 89-92.
2. Ciferri, R. 1922. Una rara malattia delle foglie del susino. Rivista di Patol. Veg. 12(5/6): 59-64.
3. Diehl, W. W. 1951. A Microstroma on peach. Plant Dis. Reptr. 35: 497.
4. Ferraris, T. 1914. Hyphales. In Flora Italica Cryptogama Pars I: Fungi (fasc. 13): 847-979.

NATIONAL FUNGUS COLLECTIONS

CROWN WART OF ALFALFA IN KENTUCKY

By N. L. Taylor and Lawrence Henson

Crown wart caused by Urophlyctis alfalfae (Lagh.) Magn. was found on alfalfa plants in Robertson County, Kentucky on July 14, 1955. The plants, reported to be 25 to 30 years old, were scattered over a rocky hillside. Characteristic warts or galls varying in size and number per plant were observed in and near the crown on 52 of 175 plants dug. The age and vigor of the warted plants indicated that while the disease may have been injurious, it was not causing serious damage. Microscopic examination of sections of the warts showed the brown resting spores which are typical of this fungus. This is apparently the first report of crown wart on alfalfa in Kentucky.

DEPARTMENT OF AGRONOMY, KENTUCKY AGRICULTURAL EXPERIMENT STATION, LEXINGTON, KENTUCKY

ANNOUNCEMENT

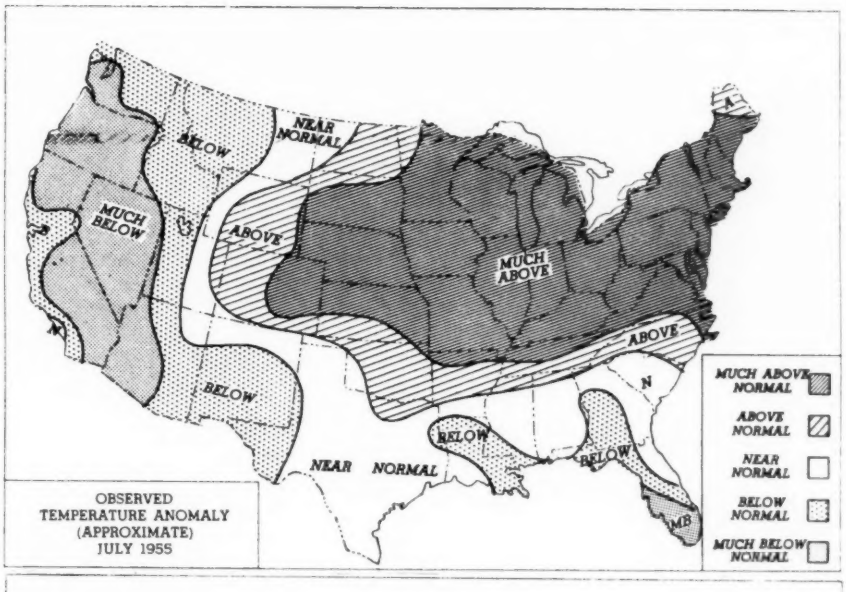
PRELIMINARY PROGRAM OF SYMPOSIA TO BE SPONSORED JOINTLY BY AAAS AND AMERICAN PHYTOPATHOLOGICAL SOCIETY AT THE ATLANTA MEETING

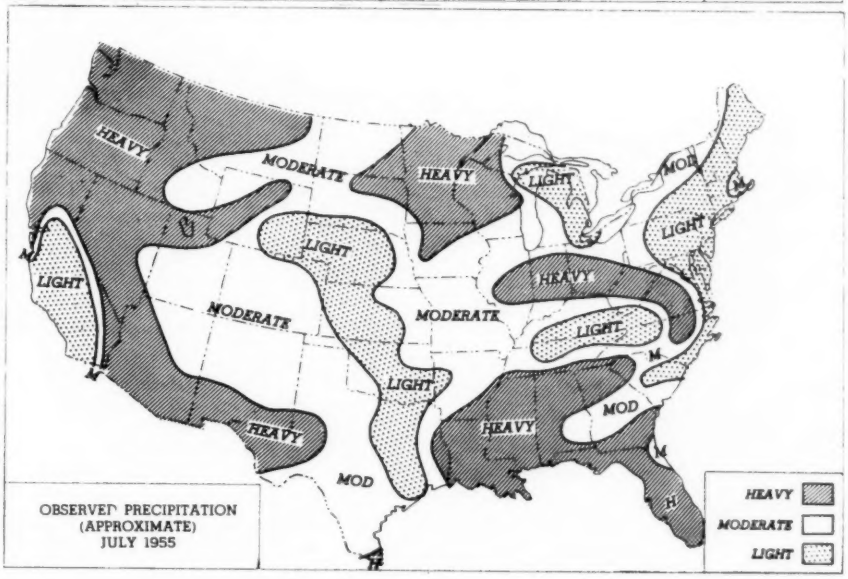
1. December 27
9:00 a.m., Municipal Auditorium, Committee Room 2
Symposium: the tobacco plant (Co-sponsored by G 1 - American Phytopathological Society)

W. G. Frankenburg General Cigar Company	Chemical Changes in Compounds of Tobacco Leaf and Cigar Smoke
M. L. Zucker Connecticut Agricultural Experimental Station	Light and the Structure of the Tobacco Leaf
H. H. Smith Cornell University	Tobacco Genetics
E. E. Clayton American Sumatra Corp.	Tobacco Pathology

2. December 27
1:30 p.m., Municipal Auditorium, Committee Room 2
Symposium: the cotton plant (Co-sponsored by G 1 - American Phytopathological Society)

To be determined	Cotton Biochemistry
Wanda K. Farr Saint Clairsville, Ohio	The Cotton Fiber
S. G. Stephens North Carolina State College	Cytogenetics of Cotton in Relation to Breeding Problems
J. T. Presley U. S. Department of Agriculture	Cotton Pathology





The terms used in the accompanying maps, which define the ranges of temperature and precipitation, are numerical class limits. These are based on a statistical analysis of past records through which is determined the normal frequency of occurrence of temperatures and precipitation at various times of the year for different locations. For temperature the classes above, below, and near normal are so defined that they each normally occur one-fourth of the time; much above and much below normal, one-eighth of the time. Precipitation is depicted in terms of light, moderate, and heavy, each class normally occurring one-third of the time and thereby having equal probability of occurrence. These maps graphically represent only the general trends and give the country's weather picture at a glance. For quantitative studies, where monthly mean temperatures and actual precipitation records are needed for a given time and place, other publications of the Weather Bureau should be consulted. P. R. M.

MANUSCRIPTS FOR THE PLANT DISEASE REPORTER

(See also PDR 35: 121-122; 36: 214, 494)

(1) GENERAL: The Reporter page measures 9 inches long with the heading or 8 3/4 inches for the text part, by 6 inches wide. The copy is typed on a larger page, 11 1/4 inches of text or 12 inches overall in length by 8 inches in width, and reduced 25 percent in the photographic process of reproduction. Illustrations or tables larger in either dimension will take a correspondingly greater reduction. Only one size of type is available for text, footnotes, or tables.

(2) MANUSCRIPTS should be the original ribbon copy, not carbons, clearly typed and double-spaced throughout, including tables, footnotes, and bibliographies. (Note -- only one copy is needed.) Footnotes should be typed at the bottom of the page.

(3) ABSTRACTS are requested for all except very short articles. (PDR 38: 316).

(4) CAUSES OF DISEASES should be named. For bacteria, fungi, nematodes, etc., give the Latin name of the organism; for viruses either or both the accepted common name of the virus or a Latin name if you prefer it and there is one; for non-parasitic diseases state the causal factor if it is known. If the cause of a disease has not been determined say so. (PDR 36: 494).

(5) LITERATURE REFERENCES should be given in alphabetical order and numbered for citation in the text. We follow the AIBS suggestion of placing the year of publication after the author's name. Please check your titles carefully since we cannot do it for you. Be sure that text citations and bibliography agree; that foreign-language references are correct; that number or month is cited for periodicals that are not paged consecutively throughout the volume.

(6) NAMES OF FUNGICIDES should be given according to the suggestions that will be published in Phytopathology before long, and later repeated in the Reporter. In the meantime see PDR 35: 122.

(7) ILLUSTRATIONS should be sent to us unmounted. To prevent mistakes, write figure numbers on the back, and mark the top of each print when necessary. A sketch can show a preferred arrangement but please keep in mind page size, shape, and standard reduction (see above under General), and remember that figure titles and legends are part of the page. Lettering should be clear and large enough to be legible after reducing. Drawings, maps, and graphs can be photographs or originals, but should be finished and ready for reproduction, not just sketches.

(8) TABLES should be carefully thought out with particular attention to the Reporter's limitations in reproduction. Make titles and headings definite and self-explanatory. Designate footnotes in tables with superscript lower-case letters. Be sure that text discussion agrees with the data in the table. Do not abbreviate names of crop varieties.

(9) REPRINTS cannot be supplied since there is no way in which we can be reimbursed. However,

(10) The MULTILITH PLATES from which reprints can be made will be sent if requested at the time the article is submitted. The press size of these plates used for the Reporter is designated as small -- maximum image 9 1/2 by 13 inches, maximum paper size 9 3/4 by 14 inches -- for Model 1250. Most of the Experiment Stations have this type of multilith machine.

(11) We are the official correspondents in the United States of the PLANT PROTECTION BULLETIN published monthly by the United Nations Food and Agriculture Organization. We would appreciate it if plant pathologists would send us suitable material from time to time for inclusion in our monthly summary reports. Please mark it clearly so that we will know it is intended for the Bulletin. (See PDR 36: 492; 37: 637) -- P. R. M.